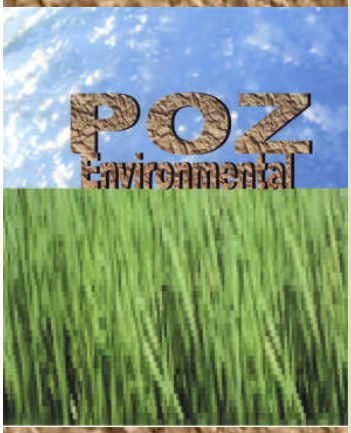
Task #1

Dec. 3, 2010

HORSE BARN ASSESSMENT



Contract # L10PA00209

Submitted to:

US, DOI, BLM

Lower Potomac Field Station

Lorton VA 22079

Prepared by:

POZ Environmental, LLC

Village Park Center

HC-87, Box 110-E

Pocono Lake, PA 183

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Task #1- Barn Assessment, Contract # - L10PA00209

INTRODUCTION

POZ Environmental, LLC (POZ) was tasked by the US, Department of Interior, Bureau of Land Management under Contract No. L10PA00209 to assess health and safety hazards for a horse barn at the Meadowood Special Recreation Management Area (SRMA) located in Lorton, Virginia, about 18 miles south of Washington DC (Figure #1 - Location Map). This assessment is primarily concerned with the structural and electrical components of the barn. POZ is an engineering firm located in northeastern Pennsylvania, practicing principles of engineering for solutions to environmental, civil, structural, and geotechnical challenges. We are licensed professional engineers. We also offer professional land surveying and state-of the-art equipment for land-surveying needs. We have scientists to study/investigate/monitor environmental, hydrological, and geological problems. We offer instrumentation and analytical methods to fulfill our science objective. We have staff that can perform quality assurance inspection and management for all construction (hazardous and non-hazardous) projects. The principal investigator for this task is Emanuel T Posluszny, P.E. and Charles Petras as an associate. Emanuel holds a BS degree in Environmental Engineering and is licensed professional engineer with 32 years of engineering experience in environmental, civil, structural, and geotechnical disciplines. Emanuel has designed and inspected numerous structural facilities for the DOI using principles of engineering. Charles Petras, who holds a BS degree from Temple University in the school of Landscape Architecture, has working experience in the construction industry for over 25 years. Both Emanuel and Charles have designed, managed, and inspected both steel and wood frame structures.

BACKGROUND

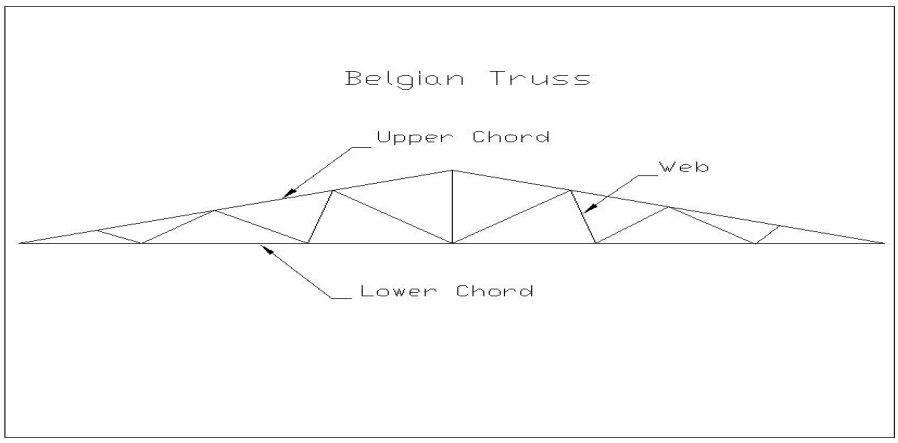
The barn is owned and managed by the Department of the Interior, Bureau of Land Management, Eastern States, who acquired 800 acres of the Meadowood SRMA in 2001 with the primary purpose of managing the open space for recreation, environmental education, and wild horse and burro interpretation. The barn is one of many structures that makes up the original riding complex/farm, which was initially a private facility. The barn is 104 feet wide by 248 feet long, and constructed in 1976. It consists of a light gage metal (aluminum) siding applied to wood framing with horse stalls located along the perimeter of the two long sides with adjacent aisles for access which are each about 13 feet wide. The complex has stalls for about 48 horses, with an office area, toilet room, mechanical room for pumps, two horse washing bays and an overhead misting system for dust suppression. The arena, located in the center of the building, has double trusses at eight foot centers with a span of 59 feet 7 inches (approximately 60 feet). The arena is approximately 190 feet long, with a platform area at one end. Behind the platform is a set-up area which takes up the remainder of the barn at approximately 40 feet in length.

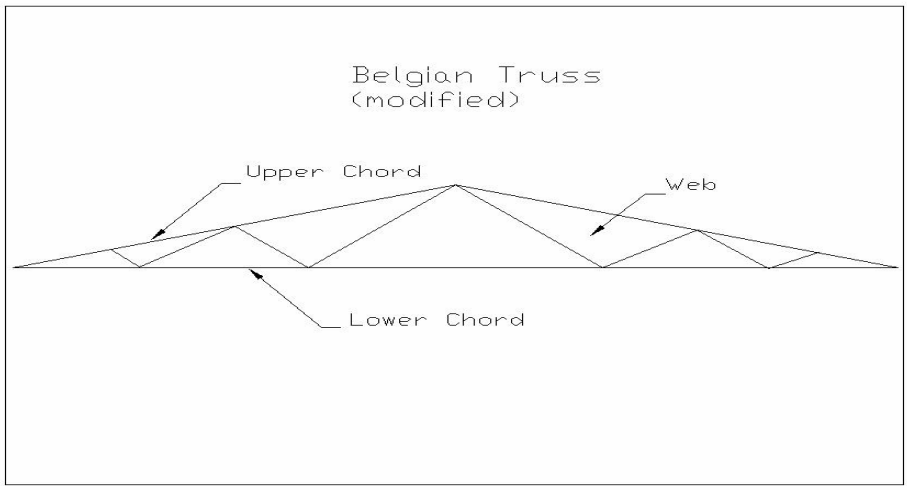
The barn is used by the government, but has private use as well, which was maintained after acquisition. In 2005, it was determined by the BLM that a water line should be extended onto the property from the main road for fire protection. The waterline was recently completed, with a fire hydrant available at the site. With a proposed fire suppression system planned, the structural integrity of the Barn was questioned with the additional loading on the interior structural members and the current condition of the electrical distribution for both power and lighting. The automatic horse watering system is antiquated. Past practices of using heat tape has increased the need for electrical power and diminished the adequacy of the

electrical system. The use of heat tape, for this application, became discouraged due to the risk of fire and overloaded the circuitry.

BLM made an in-house inspection of the barn with the following observations:
Outside covering: The metal siding and roof shows signs of wear and tear, with many loose fasteners which hold the metal wall and roof panels on. The roof leaks at various places, but apparently none are detrimental to the supporting structure or significantly impact the use below.
Water: The water distribution system which furnishes water to the automatic horse watering toughs and dust suppression system is currently above grade.
Waste: The horse wash bays (2) and the bathroom, all located at the South end of the building, drain to a septic tank located immediately outside the Southeast aisle door. During a recent effort to pump the septic tank, it was discovered that the sediment in the tank had solidified and was nearly impossible to remove. Even after excessive effort at backwashing and probing, only a marginal amount of material was able to be removed. The existing septic tank is essentially unusable due to reduced capacity and needs to be replaced. Also, due to the age of the leach field and the probability of contamination by solids, the leach field should also be replaced.
Power: The electrical service to the building is underground. The power distribution box was at capacity. The wiring is through metal jacketed conduit which utilizes boxes and connections that are not weather-tight. The interior of the building is subject to moisture from the dust suppression system, condensation, roof leaks and portions are also subject to animal contact (licking/saliva etc.). The electrical runs and fixtures do not meet an exterior exposure (waterproof / weatherproof) standard.
Fire Suppression: There was no fire suppression system or detectors in the building.
Bathroom: The current bathroom has dated fixtures, poor layout and does not meet accessibility standards.
Structural: The roof framing has some deficiencies, but in general the structure appears adequate to support current loads as well as the new sprinkler piping. The arena roof joists (2X4's) should be doubled, additional bracing should be applied to the arena trusses and some of the truss anchor points require additional blocking which is in place at most areas, but for some reason left off at others.

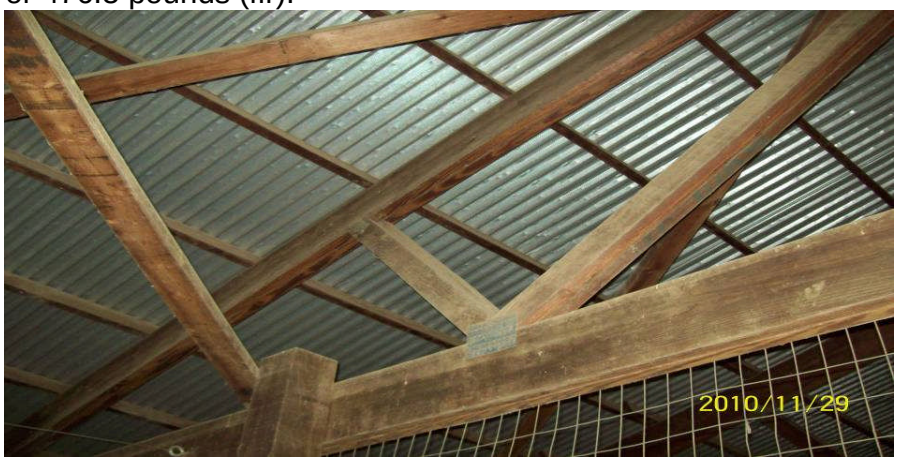
FINDING OF FACTS
This investigation consisted of inspecting immediate hazards that are life threatening to the public and livestock. These hazards were grouped into the structural and electrical component of the building (barn).
Structural Component – The structural component of the barn consists of the roof trusses, columns, beams, purlins, and sheeting.
Roof Trusses – The roof trusses are constructed as a "modified" Belgian Truss; omission of a center web-member. The truss consists of either fir or pine and has three parts:





1. Upper Chord – consists of 2 by 10 by 16 feet long lumber (1.5 inches thick by 9.5 inches wide) butted at the apex and angling to a beam on each side to a distance of 31.05 feet. The rise of the Upper Chord is approximately 14.89^{o}. The lumber is not a continuous length of board, but rather spliced together with metal meshed fasteners. These fasteners are present on both sides of the joint or only one side.
2. Lower Chord – consist of 2 by 10 by 16 feet long lumber (1.5 inches thick by 9.5 inches wide) intersecting the Upper Chord on a beam and spanning a distance of 60 feet. The lumber is not a continuous length of board, but rather spliced together with metal meshed fasteners. These fasteners are present on both sides of the joint or only one side.
3. Web – members consist of 4 - 2 by 4 lumber (1.5 inches thick by 3.5 inches wide) with varying lengths connecting the Upper Chord with the Lower Chord on each side of the truss spanning a distance of 60 feet. The average distance of individual panel points (intersecting the Upper Chord) is 8.5 feet. There is no vertical web member in the center of the truss to fully describe this truss as a Belgian.

The roof trusses are paired, placed on 8-foot centers, and jointed with 16 common nails. The nailing is either staggered or paired. Temporary supports that were used in the construction phase are still present. These supports are either not operational or bowed from suspected movement of trusses. The trusses sit on a wooden beam at each end of the 60-foot span. Tipping to the south / back of barn was observed for trusses in the south or middle area of the arena. The most northeast corner truss is rotted. The weight of each truss is 346.7 pounds (pine) or 476.5 pounds (fir).



Columns – The columns consists of 6" by 6" pine posts that are placed in post holes and extends upward to meet the elevation of the trusses. The soil around three posts (one arena and two exterior posts) were excavated to a depth of 12 to 18 inches. The excavation showed that each of the buried portion of the beam had a tar-like coating on the surface of the wood. Soil around the arena post consisted of a sandy-silt with minor clay component with easy excavation and apparent voids. One exterior column showed rotting at the surface of the wood in the soil. The arena columns were placed on 8-foot centers along the perimeter of the Arena, and 10-foot centers along the exterior perimeter of the barn with the exception of the large doorways, which is 20 feet.

Beams – The beams consisted of 2 by 12 lumber 8 feet in length which were nailed to each face of the column with 16 common nails in sets of three vertically. The beam had two components: an inner beam with the facing position toward the arena, and an outer beam positioned toward the horse stalls. The beams were not equal in elevation but had a 2.5-inch offset. The trusses were positioned on the top of the inner beam (higher in elevation), and the rafters on the outside beam (lower in elevation). At one inspection point, the inside beam was compressed by 3/8 of an inch under the position of the truss. The truss was not placed on the top of the column but rather on the inside beam at a point where it off-set the column (see photo above).
Purlins – Nailers setting on the Upper Chord for securing the metal sheeting. These consist of 2 by 4 lumber 8 feet long which were presumably nailed to the Upper Chord at 18 to 24 inches on center. The lumber was position with the heal-up and spanned the Upper Chord unsupported. The height of the purlins made it difficult to make any other observations.
Sheeting – The roof covering of the building was 4-foot wide metal sheeting, presumable steel. The sheeting was nailed in the ridges and valleys to the purlins. Sampling of its soundness consisted of gently pushing up the exposed metal sheeting at various places in random stalls. No panel of the sheeting was unsecured.

Electrical Component – The electrical component of the structure consists of wiring, lighting, distribution box, and the dust suppression system.
Wiring – The wiring consists of 10-2 BX and 12-2 BX wire. The wiring is visible and stapled to the beams and posts of the barn and run to supply power to the stalls, lighting fixtures, dust suppression systems, and power connections in general. The wiring is metal shielded to protect the wire from rodents and horses from chewing through the protective coating. The wire jacket that are exposed to the mist of the dust suppression system has a rusted surface. This is prevalent at the overhead light fixtures in the aisle between the arena and stalls.

Lighting – The lighting consists of elongated florescent tubes throughout the barn. The light fixtures are situated near and at a lower or equal elevation than the dust suppression system. Switches of the lighting are located on the walls with horse protective shields.

Distribution Box – The panel box is labeled ITT Imperial Corporation. The total amperage coming into the box is 200 amps. There are 28 positions and 26 breakers, labeled as follows:

No.	Amps	Description	No.	Amps	Description
1	20	Lighting	2	20	Power Circuits
3	20	Lighting	4	20	Power Circuits
5	20	Lighting	6	20	Power Circuits
7	20	Lighting	8	30	Hot Water Heater
9	20	Lighting	10	30	Hot Water Heater
11	20	Lighting	12	30	Suppression Sys
13	20	Lighting	14	30	Suppression Sys
15	20	Lighting	16	30	Office Heat & AC
17	15	Office	18	30	Office Heat & AC
19	15	Bathroom heat	20	20	Lighting
21	20	Refrigerator	22	20	Wash Stalls
23		Empty	24		Empty
25	20	Horse Watering Sys	26	20	Horse Watering Sys
27	20	Horse Watering Sys	28	20	Horse Watering Sys

There were no loose wires that were not capped, and no wires jumping or crossing breakers.

Dust Suppression System – The dust suppression system consisted of two Franklin Electric pumps, piping running the length of the barn in eight runs with sprayer nozzles on the top of the pipe spaced continuously throughout the run. The runs were also spaced as follows: 4 lines run longitudinally through the arena area and 2 lines ran longitudinally through the aisles between the stalls and the arena. The pumps, shown in the photo below, has the following nomenclature (Table #2 below).

Table # 2- Dust Suppression Pump Nomenclature.

Model #	1203340400	1103044409
Volts	230	115/230
HP	3	1-1/2
RPM	3450	3450
FLA	12.2	19.0/9.5
SFA	14	21.4/10.7
TYPE	N	N
HZ	60	60
FR	56J	56J
SF	1.15	1.3
Max T (C)	40	40
Time Rate	Cont	Cont
KVA code	F	J
ENC	DP	DP
PH	1	1
INS	B	B
Date Code	D94	E93

DISCUSSION OF FACTS

Structural Component – The structural component of the barn consists of the roof trusses, columns, beams, purlins, and sheeting.

Roof Trusses –The weight of each truss is 346.7 pounds (pine) or 476.5 pounds (fir). An eight-foot distance between doubled-up trusses seems to be suspect in a construction short-cut. It would be more stable and rational to space the trusses on 4-foot centers, which would decrease weight (approximately 5500 pounds) and forces on each intermediate panel. The rotted northeast truss is an obvious problem that needs to be addressed in the very near future. Although the trusses are still in position and carrying the roof loads, suspected movement has taken place over time. This movement has been identified in the titling of one truss at the south end of the barn in the arena area. It was also noted that the Lower Chord span is exceptionally long (60 feet). Some trusses, also in the southern end of the arena area, are bowing horizontally in the lower chord member. Since no supports are located between each truss, it can be hypothesized that horizontal bending is taken place. This is probably do to the suspected movement of the trusses at its apex. It is proposed that sprinkler systems are to be installed, which will add more weight to the Lower Chord and increase the weight on the moment. The lower chord members are butted together and fastened with metal plates and grommets at 16-foot intervals for the 60-foot span. No web members are arranged vertically, and only consist of 2 by 4 lumber intersecting the Upper with the Lower Chord members (2 by 10 lumber). Although the web members are attached to the Upper and Lower Chord members, the configuration and dimensions of the metal plating is inconsistent in size and application. It is obvious that there are no safety factors built into the application and construction of these roof trusses.

Columns – The columns are placed in soil with a thin coating of preservative. It would have been more fitting and structurally sound to place each column on top of concrete. Each column consists of 6” by 6” pine posts that are placed in post holes and extends upward to

meet the elevation of the trusses. The soil around three posts (one arena and two exterior posts) were excavated to a depth of 12 to 18 inches. The sampling showed that each of the buried portion of the beam had a tar-like coating on the surface of the wood. Soil around the arena post consisted of a sandy-silt with minor clay component with easy excavation and apparent voids. One exterior column showed rotting at the surface of the wood in the soil. The arena columns were placed on 8-foot centers along the perimeter of the Arena, and 10-foot centers along the exterior perimeter of the barn with the exception of the large doorways, which is 20 feet. Since the posts are the limiting factor for the structural integrity of the barn, more sampling below the ground surface is needed.

Beams – The beams consisted of 2 by 12 lumber 8 feet in length which were nailed to the face of the column with 16 common nails in three vertically sets. The beam had two components: an inner beam with the facing position toward the arena, and an outer beam positioned toward the horse stalls. The beams were not nailed together and not equal in elevation but had a 2.5-inch offset. The trusses were positioned on the top of the inner beam (higher in elevation), and the rafters between the inner column and the exterior wall of the barn on the outside beam (lower in elevation). At one inspection point, the inside beam has a compression of 3/8 of an inch under the position of the truss. The truss was not placed on the top of the column but rather on the inside beam at a point where it off-set the column. The beams have held the weight of the trusses and roof components, which was calculated to be 5500 pounds at each truss intersection. However, the weight of the roof relies on the shearing strength of the nail set and the absence of horizontal movement of the beam from the column; for example, this structure would not be appropriate for active tectonic zones. Although wind and snow forces were calculated in the 5500 pound load, periodic inspection of this loading point should be maintained because no safety factors were considered in the construction of this structure.

Purlins – Nailer setting on the Upper Chord for securing the metal sheeting. These consist of 2 by 4 lumber 8 feet long which were presumably nailed to the Upper Chord at 18 to 24 inches on center. The lumber was position with the heal-up and spanned the Upper Chords unsupported. The 8-foot span for 2 by 4 lumber is insufficient especially for live loads (repair by man). The suspected 4-foot span would, however, minimize the bending moment and therefore would satisfy and support live loads. Again, there exists of total lack of safety for the integrity of this structure component.

Sheeting – The roof covering of the building was 4-foot wide metal sheeting, presumable steel. The sheeting was screwed or nailed in the ridges and valleys to the purlins. Sampling of the nailing soundness consisted of gently pushing up the exposed metal sheeting at various places in random stalls, which resulted in the observation that the sheeting is secure to the purlins.

Electrical Component – The electrical component of the structure consists of wiring, lighting, distribution box, and the dust suppression system.

Wiring – The wiring consists of 10-2 BX and 12-2 BX wire. The wiring is visible and stapled to the beams and posts of the barn and run to supply power to the stalls, lighting fixtures, dust suppression systems, and power connections in general. The wiring is metal shielded to protect the wire from rodents and horses from chewing through the protective coating. The wire jacket that are exposed to the mist of the dust suppression system has a rusted surface. This is prevalent at the overhead light fixtures in the aisle between the arena and

stalls. Evidence of rust on the metal jacket of the wire cable suggest that it is exposed to moisture and probably from the dust suppression system. This condition presents a risk for electric shock or worse to the public and livestock. The design for the installation of the dust suppression system was either non-existent, not followed, or ill conceived.

Lighting – The lighting consists of elongated florescent tubes throughout the barn. The light fixtures are situated near and at a lower or equal elevation than the dust suppression system. Switches of the lighting are located on the walls with horse protective shields. The elevation of the lighting with respect to the dust suppression system should have been at a significantly higher elevation than both the lighting and switches.

Distribution Box – The panel box is labeled ITT Imperial Corporation. The total amperage coming into the box is 200 amps. There are 28 positions and 26 breakers without any ground fault breakers in the box. From the observations that were made, it appears that there were no breakers that were overloaded. The labeling of this box was confusing. However, the lighting and receptacles are equal to or less in elevation to the dust suppression system. If ground fault breakers were installed, it would probably make these receptacles and lighting inoperable. Again, it is obvious that the facilities of this structure was planned without any safety considerations.

Dust Suppression System – The dust suppression system consisted of two Franklin Electric pumps, piping running the length of the barn with sprayer nozzles on the top of the pipe spaced continuously throughout the run. The runs were also spaced as follows: 4 lines run longitudinally through the arena area and 2 lines ran longitudinally through the aisles between the stalls and the arena. These lines should have been positioned lower, especially with respect to the electrical system. A dust suppression system is a necessary safety consideration because electrical arching or an open flame in a dusty area can cause dust explosions. However, location of the system relative to electrical wiring is also important.

CONCLUSIONS and RECOMMENDATIONS

The safety inspection of the barn was considered to be straight forward with the conclusion that safety was not a consideration with the construction of this structure. Although the structure has withstood the test of time (34 years), it was built with “short-cuts” and no consideration for safety. As time progresses, the maintenance of this structure is expected to be costly and inappropriate. The most immediate problem that needs maintenance/replacement is the northeast corner truss. The proposed installation of fire suppression systems may result in the collapse of the truss system and roof or task the unit to its demise upon the next substantial wind or snow storm event. The current position of the dust suppression system will have to be monitored, and awareness of electric shock should be posted while the system is in operation. Ground fault circuit breakers should be installed for the lighting and receptacles in the stall aisles and arena area of the barn. Further investigations of the columns could be scheduled to determine how much rotting has taken place. This measure would also be necessary to determine the feasibility of preserving the existing structure. It is also recommended that compression at the intersecting point of the beam and the trusses, and the movement of trusses be further investigated.

SIGNATURE and CERTIFICAITON

This report is submitted to provide an analysis of the on-site inspection for the structural and electrical component with respect to safety of the horse barn at 10406 Gunston Road, Lorton VA. The inspection, analysis and report were in response to a task order by Jeffrey McCusker issued under Contract # L10PA00209 on November 19, 2010.

EMANUEL T POSLUSZNY, P.E.
POZ Environmental, LLC

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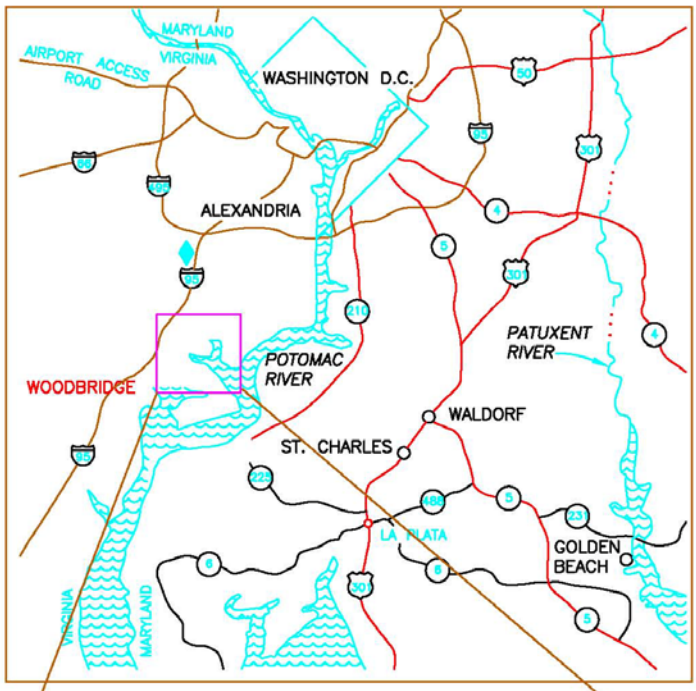
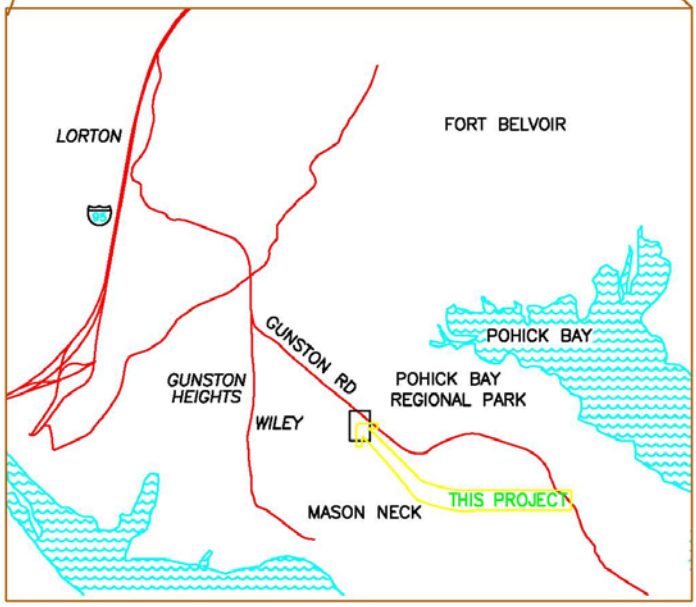


REGIONAL MAP



VICINITY MAP